



School of Economics and Management

TECHNICAL UNIVERSITY OF LISBON

Department of Economics

Nuno Leitão, Horácio Faustino and Yushi Yoshida

***Determinants of Vertical Intra-Industry Trade in the
Automobile Manufacturing Sector: globalization and
fragmentation***

WP 06/2009/DE/SOCIUS

WORKING PAPERS

ISSN N° 0874-4548



Determinants of Vertical Intra-Industry Trade in the Automobile Manufacturing Sector: globalization and fragmentation

Nuno Carlos Leitão

ESGTS, Polytechnic Institute of Santarém, Portugal

Horácio C. Faustino

ISEG, Technical University of Lisbon, and

Yushi Yoshida

Faculty of Economics, Kyushu Sangyo University, Japan

Abstract: This paper examines the determinants of vertical intra-industry trade (VIIT) in the automobile components industry between Portugal and the European Union 27 (EU-27) and the BRIC countries (Brazil, Russia, India and China) during the period 1995-2006. Using a static and a dynamic panel data analysis, the results indicate that VIIT is a positive function of the difference in per-capita GDP between Portugal and its trading partners. Moreover, there is statistical evidence that geographical distance and proximity shared border influence this type of VIIT. Our results also confirm the hypothesis that trade increases if the transportation costs decrease and that there is a positive correlation between differences in endowments and VIIT.

Key Words: VIIT, intermediate goods, automobile manufacturing industry, panel data, fragmentation, globalization.

JEL Code: F14

Addresses:

Nuno Carlos Leitão (*corresponding author*)

Escola Superior de Gestão e Tecnologia de Santarém, Complexo Andaluz 295 2001-904 Santarém,

Portugal.T: (+351) 243303200 ;E-mail: nuno.leitao@esg.ipsantarem.pt; nunocarlosleitao@gmail.com

Horácio C. Faustino

IZEG- Instituto Superior de Economia e Gestão, Rua Miguel Lúpi, 20. 1249-078 Lisboa, Portugal T: (+351) 213925902

Email: faustino@izeg.utl.pt.Home Page: www.iseg.utl.pt/~faustino

Yushi Yoshida

Kyushu Sangyo University,
2-3-1 Matsukadai, Higashi-ku, Fukuoka, 813-8503 Japan.

Email: yushi@ip.kyusan-u.ac.jp

I. Introduction

The role of the multinational corporations (MNC) in the fragmentation/outsourcing of the production can be observed through the statistics dealing with international trade. Since the 1970s, approximately one-third of US exports and imports have taken the form of sales by one unit of an MNC to another unit. The trade in automobile components between different units of multinational corporations is a good example of this type of trade, mainly vertical intra-industry trade (VIIT).

The term outsourcing is often used to describe cases in which an M relocates part of its production away from the home country to another country. In most cases, the foreign firm is a subsidiary of the MNC. In other cases, the MNC subcontracts the operation concerned to a foreign firm. Outsourcing is discussed in the context that MNCs are purchasing inputs from abroad. Outsourcing has grown because firms seek to reduce labor-market costs.

Vertical IIT reflects the exchange of intermediate goods which belong to the same industry, but which are located at different stages in the production process. Following recent literature, we apply country-specific variables, such as per-capita income, distance, relative factor endowment, and shared borders, to explain VIIT.

This study analyzes the determinants of VIIT between Portugal and 25 countries (21 countries of the European Union 27 (EU-27), 3 of the BRIC countries (Brazil, Russia, India) and USA) in the automobile parts and components industry¹. The paper uses an unbalanced panel for the period 1995-2006. We have followed such other empirical studies as Turkcan (2003, 2005), Clark (2006), Wakasugi (2007), Kimura et al. (2007), Yoshida (2005), Reis and Rua (2006) and Amador and Cabral (2008).

In static panel data, pooled OLS, fixed-effects (FE) and random-effects (RE) estimators are used in this type of study. The RE estimator was excluded because our sample is not random. Furthermore, the Hausman test rejects the null hypothesis RE versus FE. We decided against using the fixed-effects estimator, as some relevant variables do not vary along time. Therefore, the regression coefficients are estimated using OLS with time dummies. We also decided to introduce a dynamic panel data.

¹ Russia and the remaining six EU countries were excluded due to the unavailability of data. In addition, note that Belgium and Luxembourg are treated as one combined economy.

The estimator used (GMM-SYS) permits researchers to solve the problems of serial correlation, heteroskedasticity and endogeneity of some explanatory variables. These econometric problems were resolved by Arellano and Bond (1991), Arellano and Bover (1995), and Bond (1998, 2000), who developed the first-differenced GMM estimator (GMM-DIF) and GMM system estimator (GMM-SYS).

The remainder of the paper is organized as follows. The second section reviews the theoretical literature. The third section analyzes the relationship between fragmentation and vertical intra-industry trade. The fourth section reports the recent trend in Portuguese vertical intra-industry trade. The fifth section presents the econometric model. In the sixth section, we analyze the results, and the final section concludes.

II. Literature Review

Jones and Kierzkowski (1990, 2000, 2001) and Deardoff (1998, 2001) were the first researchers to use the concept of fragmentation in the international trade theory. However, the term fragmentation is found to correspond to various differing definitions in the literature. Fragmentation is synonymous with “outsourcing” for Feenstra and Hanson (1995, 1996, 1997, and 2001), equal to “disintegration of production” for Feenstra (1998), equal to “vertical specialization” for Hummels, Rapoport, and Ke-Mu Yi (1998), and with “intra-product specialization” for Arndt (1997, 1998, and 2001).

Nowadays, it is generally accepted that the pioneering literature on fragmentation began with Jones and Kierzkowski (1990). According to these authors, fragmentation involves a place where production costs can be substantially reduced. Jones and Kierzkowski (2001) argue that changes in the price of production factors permit us to explain the increase of fragmentation. The outsourcing place/outsourced destination presents comparative advantages in low wages and a favorable stability in economic policy.

Recently, researchers of international fragmentation or outsourcing, such as Ando (2006), Clark (2006), Kimura et al. (2007) and Wakasugi (2007), have explained the determinants of fragmentation by gravity models (economic dimension, geographical distance, shared borders and cultural proximity).

The study of Clark (2006) demonstrated that globalization will continue to reinforce the idea that there are locations that are more efficient (i.e., with low production costs), which is linked to vertical specialization. Clark used a tobit and probit specifications at country and industry level.

Fragmentation of production among East Asian countries is widely supported by empirical evidence. Ando (2006) studied the fragmentation and vertical intra-industry trade (VIIT) in East Asia. The author concluded that vertical international production became an essential part of each economy in East Asia. In the 1990s, an increase in the vertical specialization in machinery parts and components took place.

Kimura et al. (2007) analyzed the determinants of fragmentation and machinery parts and components of among East Asian, European and other countries. In the gravity model, the trade in parts and components is regressed on the difference of GDP per capita, in addition to the incomes of trading partners and the geographical distance between them. The authors find that a larger income gap increases the components trade among East Asian countries, while similar incomes promote greater components trade among European countries. They conclude that the trade in components among East Asian countries is more a case of vertical trade driven by the fragmentation of machinery production.

Yoshida (2005) examined the regional trade of automobile parts and components among Asian countries. By using Japanese FDI, distinguishing automobile makers such as Toyota and Honda from automobile components suppliers such as Denso, empirical results support that FDI by automobile suppliers promotes the component trade among Asian countries. This is regardless of whether a host country is an importer or an exporter, whereas FDI by an automobile maker only contributes to promoting regional trade in components when a host country is an importer.

Wakasugi (2007) constructed an index of vertical intra-industry trade to measure the fragmentation of production. The author used a gravity model and analyzed the impact of VIIT in East Asia, NAFTA, and the European Union. The author concluded that fragmentation increased with intra-industry trade.

While empirical evidence on fragmentation in Asia is substantial, it is less so with regard to the European region. In this paper, we attempt to fill this gap. We provide empirical evidence on fragmentation among European countries, particularly

from the perspective of a small, medium-income country, i.e., Portugal. It is of interest to discover whether the effect of an income gap on the components trade is positive, as found in Kimura et al. (2007). In addition, departing from the use of uni-directional trade flows, as found in the existing literature, we use a vertical intra-industry trade index for automobile components as a dependent variable. Our paper, focusing on the automobile sector in the EU, and taking into account other bilateral partners such as the USA, Brazil, China and India, is also a complimentary study to Yoshida (2005), which examines the automobile components trade in Asia.

III. Fragmentation and vertical intra-industry trade

When the production of the finished good requires multiple stages, we have fragmentation, or outsourcing². As Turkean (2003) points out, before the 1960s, firms produced themselves all of the components used in assembling the final good. However, the costs of producing the final product and the intermediate goods have increased as time has progressed. With globalization, the world economy presents new clusters of industries. For example, India (see Eiteam and Moffett, 2007) has developed a highly efficient, low-cost software industry. In China, the principal activities are chemical, mechanical and petroleum-engineering services. Russia has developed software and engineering services and R&D centers. Japan and Mexico are highly efficient in car manufacturing and electronic services.

According to Kol and Rayment (1989) the exchange of intermediate goods can be divided into horizontal IIT and vertical IIT. Kol and Rayment (1989) suggest the unit values of exports and imports of intermediate goods to separate total IIT into its horizontal and vertical components.

Horizontal intra-industry trade in intermediate goods cannot be explained by the factor proportions theory, because we have the same quality, costs and factor proportions (K, L) employed in the production.

² Hummels et al. (1998), examining the importance of trade in intermediate goods, used a vertical specialization index as a measure of fragmentation. Based on their approach, vertical specialization occurs when a country uses imported intermediate goods to produce goods that will later be exported. If the country does not export them later, outsourcing has occurred, but vertical specialization has not occurred.

Vertical intra-industry trade in intermediate products is explained by the HO (Heckscher-Ohlin) model, associated with multiple stages of production.

Grubel and Lloyd Indexes

Grubel and Lloyd (1975) define IIT as the difference between the trade balance of industry i and the total trade of this same industry. In order to make comparisons easier between industries or countries, the index is presented as a ratio, where the denominator is total trade.

$$IIT_{it} = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \Leftrightarrow IIT_{it} = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \quad (1)$$

The index is equal to 1 if all trade is intra-industry. If IIT_{it} is equal to 0, all trade is inter-industry trade.

Grubel and Lloyd (1975:22) proposed an adjustment measure to the country IIT index (IIT calculated for all individual industries), introducing the aggregate trade imbalance.

Aquino (1978: 280) also considered that an adjustment measure is required, but to a more disaggregated level, but for this, the Grubel and Lloyd method is inadequate. Following Aquino, we require an appropriate imbalance effect. The imbalancing effect must be equi-proportional in all industries. So, the Aquino at the 5-digit level estimates “what the values of exports and imports of each commodity would have been if total exports had been equal to total imports”.

HIIT and VIIT Indexes

To determine the horizontal and vertical intra-industry trade, Grubel and Lloyd indexes and the methodology of Abd- el – Rahaman (1991) and Greenaway et al. (1994) are used.

$$HIIT_{it} = \frac{RH}{(X_i + M_i)} \quad (2)$$

HIIT- horizontal intra-industry trade index;

RH- total horizontal intra-industry trade;

TT_{ij} - relative unit values of exports and imports are used to disentangle HIIT and VIIT;

If $TT_{ij} \in [0.85; 1.15]$, we have horizontal IIT;

$$VIIT_{it} = \frac{RV}{(X_i + M_i)} \quad (3)$$

VIIT- vertical intra-industry trade index;

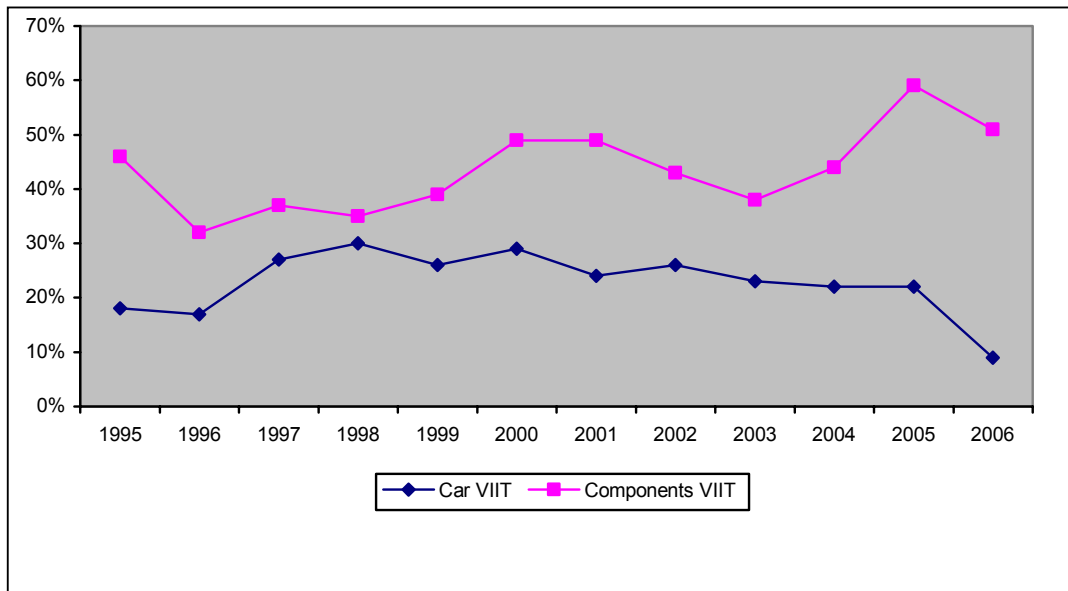
RV- total vertical intra-industry trade;

If $TT_{ij} < 0.85$ V $TT_{ij} > 1.15$, we have vertical IIT. When $TT_{ij} < 0.85$, we have inferior VIIT (lower quality). When $TT_{ij} > 1.15$, we have superior VIIT (higher quality).

IV. The Recent trend in Portuguese vertical intra-industry trade: the car industry

As shown in figure 1, automobile components account for more than 40% of Portuguese VIIT in the period 2000-2006.

Figure 1. Vertical Intra-industry Trade in the Portuguese Components Sector and in the Total Car Industry



This is also the case for the year 1995. For the period 1996-1998, car components account for more than 30%. When we compare these values with the total car industry, we note that the index of VIIT decreases. For the period 1999-2005, total car VIIT industry did not account for more than 20%.

V. Econometric model

The dependent variable used is vertical intra-industry trade (*VIIT*) in car components. It is calculated with the disaggregation of five digits CAE (Economic Activities Classification) of the automobile components. The data for the explanatory variables is sourced from the World Bank, World Development Indicators (2005). The source used for the dependent variable was INE – the Portuguese National Institute of Statistics.

V.1. Explanatory variables and the testing of hypotheses

Hypothesis 1: There is a positive relationship between differences in per-capita income and VIIT

LogDGDP is the logarithm of absolute difference in per-capita GDP (PPP, in current international dollars) between Portugal and the trading partner. Falvey and Kierzkowski (1987) suggest a positive sign for the VIIT model. Turkcan (2005) and Wakasugi (2007) found a positive sign when they studied the fragmentation of production in transactions of parts and intermediate goods.

Hypothesis 2: VIIT occurs more frequently among countries that are different in terms of factor endowments

LogEP is a proxy for differences in physical capital endowments. It is the logarithm of the absolute difference in electric power consumption (Kwh per capita) between Portugal and its partners. Based on Helpman and Krugman (1985), we expected a positive sign for the coefficient of this explanatory variable. Zhan et al. (2005) found a positive sign for the Chinese case.

Hypothesis 3: There is a negative correlation between trade imbalance and VIIT

LogTIMB is the trade imbalance in logarithmic form. Following Lee (1993), we consider the trade imbalance as a control variable, where TIMB is defined as:

$$\text{LogTIMB} = \frac{|X_j - M_j|}{(X_j + M_j)} \quad (4)$$

This variable represents the net trade as a share of trade and takes a value of zero at the lower extreme if there is no trade imbalance and a value of one if there are neither exports nor imports. According to the theory, a negative correlation between this control variable and VIIT is expected.

Hypothesis 4: The trade increases if the transportation cost decreases

LogDIST is the logarithm of geographical distance between Portugal and the partner-country. The cost of transports is important as a trade policy variable. According to the literature, a negative sign is expected.

LogNAUTIC is the nautical distance between Portugal and the partner-country. It is used as the second proxy for the transportation cost.

Balassa (1986) argues that intra-industry trade will be greater when trading partners are geographically close. Clark (2006) analyzed the international fragmentation of production of parts and components and found a negative sign for this distance variable.

Hypothesis 5: There is a positive relationship between BORDER and VIIT

BORDER is a dummy variable that equals 1 if the partner-country shares a border with Portugal (i.e, Spain) and 0 otherwise. A positive sign is expected.

V.2. Model Specification

$$VIIT_{it} = \beta_0 + \beta_1 X_{it} + \delta t + \eta_i + \varepsilon_{it} \quad (5)$$

Where $VIIT_{it}$ is the Portuguese VIIT index, X is a set of explanatory variables. All variables are in the logarithmic form; η_i is the unobserved time-invariant specific effects; δt captures a common deterministic trend; ε_{it} is a random disturbance assumed to be normal and identically distributed (IID) with $E(\varepsilon_{it})=0$; $Var(\varepsilon_{it})=\sigma^2 > 0$.

The model can be rewritten in the following dynamic representation:

$$VIIT_{it} = \rho VIIT_{it-1} + \beta_1 X_{it} - \rho \beta_1 X_{it-1} + \delta t + \eta_i + \varepsilon_{it} \quad (6)$$

Since VIIT is an index varying between zero and one, we apply a logistic transformation to VIIT, as in Hummels and Levinsohn (1995). $VIIT = \text{Ln}[VIIT/(1-VIIT)]$. We decided against using the fixed-effects estimator, because some relevant variables such as geographical and nautical distance do not vary along the time. We control for the time effects by including a time dummy variable and the regression coefficients are estimated using OLS with time dummies, and a GMM-System estimator.

VI. Estimation Results

Table 1 presents the estimation results using OLS estimator with time dummies. All explanatory variables are significant at 1% and 10% level. The general performance of the model is satisfactory; the results are according to the hypothesis formulated with the exception of nautical distance.

Table 1: Fragmentation and Vertical Intra-Industry Trade

Variables	Coefficient	Expected Signs
LogDGDP	1.065 (1.77)*	(+)
LogEP	1.554 (3.26)***	(+)
LogTIMB	-0.710 (-1.92)*	(-)
LogDIST	-5.888 (-5.09)***	(-)
LogNAUTIC	4.238 (7.38)***	(-)
BORDER	1.926 (3.09)***	(+)
C	-2.716 (-0.888)	
Adj. R ²	0.329	
Observations	156	

OLS estimator with time dummies. T-statistics (heteroskedasticity corrected) are in round brackets. ***/*- statistically significant respectively at the 1% and 10% levels.

The variable LogDGDP is statistically significant, with the expected sign. As the variables are in the log form, the coefficient of LogDGDP gives the elasticity. So, when the difference in per-capita GDP increases by 1%, the VIIT in car components increases by 1.065%.

As expected, the variable BORDER has a significant and positive effect on VIIT.

The coefficient of LogDIST (Distance) is negative as expected. This result confirms the gravitational model and the importance of the proximity of the trading partners.

The variable electric power in logs (LogEP) presents a positive sign, confirming the theoretical forecast.

The control variable (TIMB) in logs is statistically significant at 10% with a correct sign.

The dynamic panel data model, presented below in Table 2, is valid if the estimator is consistent and the instruments are valid. The Sargan test of over-identifying restrictions tests the validity of instruments used. The first- and second-order serial correlation in residuals is tested by M_1 and M_2 statistics. The GMM system estimator is consistent if there is no second-order serial correlation. The Sargan test and M_2 statistic verify that the instruments used are valid.

Comparing the GMM estimates with OLS, we note that TIMB becomes insignificant.

The variable DGDP is statistically significant, with an expected positive sign. Our result is in accordance with Turkcan (2005) and Wakasugi (2007).

As in Zhan et al. (2005), the logarithm of the difference in electric power consumption has a positive effect on the VIIT variable. Thus, we can say that the difference in relative factor endowments explains the VIIT in car components.

BORDER has been used as a typical gravity model variable. A positive effect of a common border on bilateral intra-industry trade was expected and the results are in conformity with this expectation, as in Kimura et al. (2007):

Table 2: Fragmentation and Vertical Intra-Industry Trade

Variables	Coefficient	Expected Sign
LogiVIIT _{it-1}	0.090 (0.624)	(+)
LogDGDP	1.880 (1.70)*	(+)
LogEP	1.172 (3.01)***	(+)
LogTIMB	-0.815 (-1.24)	(-)
Log DIST	-3.848 (-1.90)*	(-)
LogNAUTIC	5.661 (4.50)***	(-)
BORDER	2.502 (1.73)*	(+)
C	-17.201 (-2.32)**	
M ₁	-0.3397 [0.734]	
M ₂	-0.1032 [0.918]	
W _{js}	4.351 [0.824] df=8	
Sargan	8.389 [1.000] df=152	
Observations	106	
Parameters	9	
Individuals	18	

The instruments in levels used by GMM estimator were: LogiVIIT_{it} (2,6), LogEP(2,6), and LogTIMB(2,6), LogLNAUTIC(2,6) for first differences. For levels equations, the instruments used are first differences of all variables lagged t-1. The null hypothesis that each coefficient is equal to zero is tested using one-step robust standard error. T-statistics (heteroskedasticity corrected) are in round brackets. *, **, *** means statistically significant, respectively at the 10%, 5% and 1% level. P-values are in square brackets. Year dummies are included in all specifications (this is equivalent to transforming the variables into deviations from time means). M1 and M2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation (based on the efficient two-step GMM estimator). W_{JS} is the Wald statistic of joint significance of independent variables (for first-steps, excluding time dummies and the constant term). Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instruments' validity (with two-step estimator).

VII. Conclusions

In this paper, we have analyzed the evolution and main determinants of vertical intra-industry trade (VIIT) in the automobile components sector. In the case of Portugal, there is evidence of the growing importance of fragmentation of production in the automobile sector, using the VIIT index in car components as a measure of fragmentation. In the static and dynamic panel data analysis this study confirms that fragmentation can be explained by the Heckcher-Ohlin theory (HO) – the difference in relative factor

endowments and factor proportions used to produce the goods explain the VIIT in intermediate products, which in this specific case is car components. The Linder hypothesis that difference in per-capita incomes can explain intra-industry trade is also found to be statistically significant in explaining the VIIT in car components. The higher the difference in per-capita GDP, the higher will be the fragmentation of production measured by the VIIT index. However, although our paper finds a positive coefficient for per-capita GDP difference, Kimura et al. (2007) estimated a negative coefficient for Europe .

The gravity model also contributes very well to explaining the fragmentation of automobile production. The variable Distance is statistically significant and the negative coefficient confirms that the transportation cost is an important explanatory variable of trade in components. In the Portuguese case, outsourcing in the car industry is negatively affected by the distance between Portugal and other countries.

Outsourcing and fragmentation is generally discussed in the context of multinational corporations (MNC) theory and the role of these firms in international trade and globalization. It is well known that MNCs are always seeking to purchase cheap inputs from abroad. With globalization, the role of MNCs in international trade is increasing. Outsourcing has grown because these firms have sought to reduce their labor costs. The MNCs are advocates of free trade and, as such, strongly favor outsourcing. However, there are winners and losers from free trade. As income distribution is affected by trade, there is always controversy in relation to outsourcing and fragmentation.

Some empirical studies estimate that 70% of the income gains from outsourcing go to the outsourcing country and the remaining 30% go to the country that carries out the outsourced activity. All trade theorists agree that outsourcing promotes trade. The effects of fragmentation and globalization on income distribution are a matter of empirical evidence and this topic merits further research. Portugal, gains from the outsourcing of its car industry and it is to be hoped that eventually, when the economic climate improves, outsourcing may also generate much-needed employment gains for the country. Productivity may increase and the increase of profits can lead to the expansion of the sector. However, this hypothesis must be tested.

References

- Abd-El-Rahman, K. (1991) Firms' competitive and national comparative advantage as joint determinants of trade composition. *Weltwirtschaftliches Archiv/Review of World Economics*, 127(1): 834-97.
- Aquino, A. (1978) Intra-industry trade and inter-industry specialization as concurrent sources of international trade in manufacturing. *Weltwirtschaftliches Archiv/Review of World Economics*, 114 (2), 275-295.
- Amador, J. and Cabral, S. (2008) Vertical specialization across the world: A relative measure, Working Paper 10-2008, Banco de Portugal.
- Ando, M. (2006) Fragmentation and vertical intra-industry trade in East Asia. *The North American Journal of Economics and Finance* 17(3), 257–281.
- Arndt, S. W. (1997) Globalization and the open economy. *The North American Journal of Economics and Finance* 8(1), 71–79.
- Arndt, S. W. (1998) Super- specialization and the gains from trade. *Contemporary Economic Policy* XVI: 480-485.
- Arndt, S. W. (2001) Offshore sourcing and production sharing in preference areas. In S. Arndt and H. Kierzkowski (eds). *Fragmentation: New production patterns in the world economy*. Oxford University Press.
- Arellano, M., and S. Bond (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58 (2): 277-297.
- Arellano, M., and O. Bover (1995) Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1):29-51.
- Balassa, B., and BAUWENS (1987) Intra-Industry Specialization in a Multi-Country and Multi-Industry Framework. *The Economic Journal*, 97(388): 923-939.
- Blundell, R., and S. Bond (1998) Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115-143.
- Blundell, R., and S. Bond (2000) GMM estimation with persistent panel data: An application to production functions. *Econometric Reviews*, 19(3): 321-340.
- Clark D. (2006) Country and industry-level determinants of vertical specialization based trade. *International Economic Journal* 20(2), 211–225.
- Deardorff, A. V. (1998) Fragmentation in simple trade models. Working Paper 422, Research Seminar I International Economics, University of Michigan.
- Deardorff, A. V. (2001) Fragmentation across cones, In S. W. Arndt and H. Kierzkowski, eds, *Fragmentation: New Production Patterns in the World Economy*, Oxford University Press, USA, chapter 3, pp. 35–51.
- Eiteam, D, Stonehill, I., Moffett, H. (2007). *Multinational Business Finance, Comparative Corporate Governance and Financial Goals*, Pearson (eds), chapter 16.
- Feenstra, R. C. and Hanson, G. H. (1996) Globalization, outsourcing, and wage inequality. *The American Economic Review* 86(2), 240–45.
- Feenstra, R. C. and Hanson, G. H. (1997) Foreign direct investment and relative wage: evidence from Mexico's maquiladora's. *Journal of International Economics* 42: 371-393.
- Feenstra, R. C. and Hanson, G. H. (2001) Global production and rising inequality: a survey of trade and wages. NBER.
- Feenstra, R. C. (1998) Integration of trade and disintegration of production in the global economy. *Journal of Economic Perspectives* 12:31-50.

- Falvey, R. and Kierzkowski, H. (1987) Product Quality, Intra-industry Trade and (Im) Perfect Competition. Corden: 143-161. Oxford, USA: Basil Blackell.
- Grubel, H., and P. Lloyd (1975) *Intra-Industry Trade. The Theory and Measurement of International Trade in Differentiation Products*, The Macmillan Press, London.
- Greenaway, D., R. Hine, C. Milner (1994) Country-specific factors and the pattern of horizontal and vertical intra-industry trade in the UK. *Weltwirtschaftliches Archiv/Review of World Economics* , 130(1):77-100.
- Helpman, E. and Krugman, P. (1985) *Market structure and foreign trade*, Brighton, UK: Harvester Wheatsheaf.
- Hummels, D., Rapoport, D. and Yi, K.-M. (1998) Vertical specialization and the changing nature of world trade. *Federal Reserve Bank of New York Economic Policy Review* 4(2), 79-99.
- Jones, R. W. and Kierzkowski, H. (1990) The role of services in production and international trade: A theoretical framework, In R. W. Jones and A. Krueger, (eds), *The Political Economy of International Trade*, Oxford, Basil Blackwell chapter 3, pp. 31-48
- Jones, R. W. and Kierzkowski, H. (2000) Globalization and fragmentation of production. CIES Policy Discussion Paper 0010.
- Jones, R. W. and Kierzkowski, H. (2001) A framework for fragmentation, in S. W. Arndt and H. Kierzkowski, eds, *Fragmentation: New Production Patterns in the World Economy*, Oxford University Press, USA, chapter 2, pp. 17-34.
- Lee Young (1989) A Study of The Determinants of Intra-Industry Trade Among the Pacific Basin Countries, *Review of World Economics/Weltwirtschaftliches Archiv*, 125,(2): 346-358.
- Kimura, F., Takahashi, Y. and Hayakawa, K. (2007), Fragmentation and parts and components trade: Comparison between East Asia and Europe. *The North American Journal of Economics and Finance* 18(1), 23-40.
- Kol, J. Rayment, P. (1989). Allyn-Young specialization and intermediate goods in intra-industry trade, in P.K.M Tharakan and Jacob Kol (eds). *Intra-industry trade: theory and extensions*, St. Martin's Press, New York.
- Reis, H. and Rua, A. (2006) An Input-Output analysis: linkages vs leakages, Working Paper 17-2006, Banco de Portugal.
- Turkcan, K (2003) *Determinants of Intra-industry trade in intermediate goods between the US and OECD*, PhD dissertation, Faculty of North Carolina State University.
- Turkcan, K. (2005) Determinants of Intra-Industry Trade in Final Goods and Intermediate Goods between Turkey and Selected OECD Countries. *Istanbul University Econometrics and Statistics e-Journal* ,1 (1): 21-40.
- Wakasugi, R. (2007), Vertical Intra-Industry Trade and Economic Integration in East Asia. *Asian Economic Papers*, 6, 26-45.
- Yoshida, Y (2005), Outsourcing of Intermediate Manufacturing Products in Asian Economies, *Kyushu Sangyo University Discussion Paper*, No. 21.
- Zhan J. Witteloostuijn, A and Zhou, C. (2005) Chinese bilateral intra-industry trade: A panel data study for 50 countries in the period 1992. *Weltwirtschaftliches Archiv/Review of World Economics*, 141 (3): 510-540.